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Acoustic Doppler Current Profiler

ADCP

on

RV “Heincke”

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Contents

1 ADCP Installation Overview 3
1.1 Sensor Equipment 3
1.2 Sensor Structure 3
1.3 Software 4
2 System Start-up 5
2.1 Switch on ADCP 5
2.2 System Test (BBTalk) 5
3 VmDas Acquisition Software 7
3.1 Communications Settings 8
3.2 ADCP Settings 9
3.3 Changes in the ADCP Setup File 10
3.4 Recording Settings 10
3.5 Navigation Settings 11
3.6 Transformation Settings 12
3.7 Averaging Settings 13
3.8 Data Screening Settings 14
3.9 Short Term Averages (STA) in VmDas 14
4 WinADCP 16
4.1 Exporting Data 16

Document history		
Version	**Date**	**Description**
1	03.04.2012	First version of this manual
2	18.03.2015	600kHz ADCP added

1 ADCP Installation Overview

1.1 Sensor Equipment

The following sensors are installed on the RV “Heincke”:

Table 1: Sensor specification

Sensor	Model	Details from Manufacturer
ADCP 150 kHz - vessel mounted -	Teledyne RDI Ocean Surveyor	Range: 400 m Vertical resolution cell size: 4 - 8 m Velocity accuracy: ± 1.0 % of the water velocity relative to the ADCP ± 0.5 cm/s Velocity resolution: 9 - 30cm/s Number of depth cells: 1 - 128
ADCP 600 kHz - portable for moon pool -	Teledyne RDI Workhorse Mariner	Range: 50 m Vertical resolution cell size: 0.5 - 4 m Velocity accuracy: 0.3 % of the water velocity relative to the ADCP ± 0.3 cm/s Velocity resolution: 0.1 cm/s Number of depth cells: 1 - 128
Inertial Navigation System (INS)	IXSea Phins	Heading accuracy: 0.05 deg (without aiding) Roll, Pitch accuracy: 0.01 deg Heave accuracy: 5 cm or 5%
Primary Positioning Unit	Trimble SP461	Primary Positioning system DGPS 0.5 - 3 m accuracy
Secondary Positioning Unit	DEBEG/Leica	Secondary Positioning system GPS 5 - 15 m accuracy

1.2 Sensor Structure

Figure 1 shows the sensor structure of the ADCP hardware and Figure 2 shows the installation in the laboratory. The 150 kHz transducer is hull mounted, the 600 kHz transducer is portable and has to be mounted in the moon pool. The deck units of both ACDPs are permanently installed in the server rack next to the operator PC. The operator PC receives ADCP data from one ADCP deck unit at a time, position information from the GPS Debeg receiver OR the Trimble DGPS receiver as well as attitude data (heading) from the IXSea PHINS III Inertial navigation system (INS). Only one of the two GPS receivers can be selected as the positioning input. This can be done by a switch, which is installed on the bridge. However we recommend using the Trimble GPS as it provides a more accurate position than the Debeg GPS so make sure the switch is set accordingly. Recorded data should be regularly copied to the network shares of the XDC storage server.

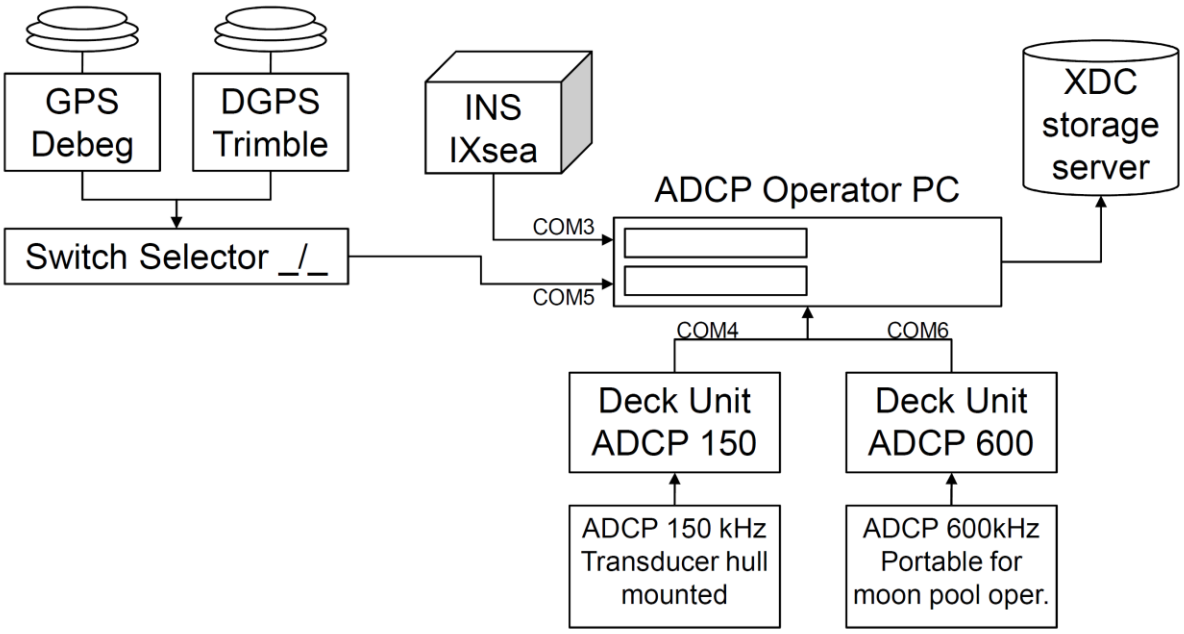

Figure 1: Sensor dependencies

Figure 2: Installation in the laboratory

1.3 Software

The software *VmDas* (Vessel-mount data acquisition system) is used for data acquisition and configuration of the ADCP. The software *WinADCP* can be used for visualization and export of recorded raw data. Both software packages are installed on the ADCP operator PC.

2 System Start-up

This manual is created for the specific use of the ADCP on RV “Heincke” and focuses on the most important parameters to be looked after during data acquisition. We recommend to additionally read the ***VmDas Quick Start Guide*** and ***VmDas User Guide***.

2.1 Switch on ADCP

1. Power up the ADCP operator PC (Figure 2, right)
2. Power up the deck unit in the server rack (Figure 2, right)

2.2 System Test (BBTalk)

Before you start a survey you should perform a hardware system test.

1. Start the BBTalk program from the desktop of the operator PC.
2. Connect to the ADCP unit by selecting the settings as shown in Figure 3.

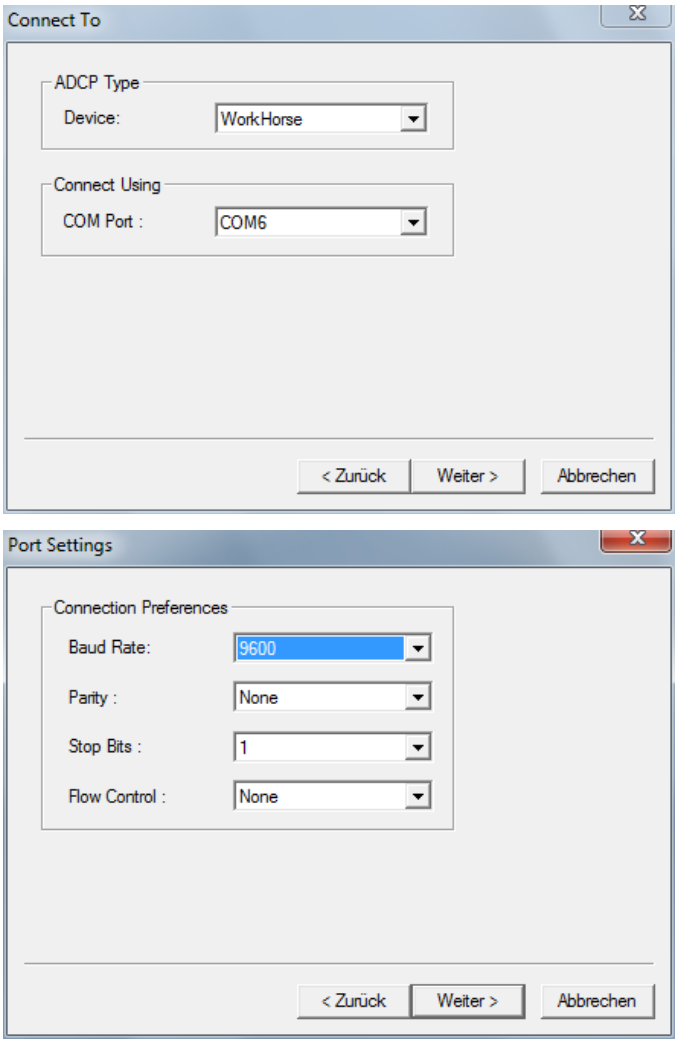

Figure 3: Serial connection settings in BBTalk (600kHz Workhorse Mariner as example)

3. Choose menu ***File → Options*** and select settings as shown in Figure 4.

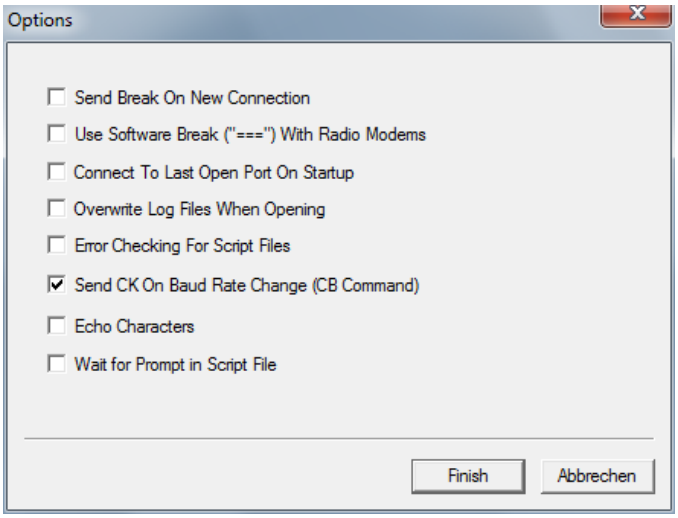
Options
Send Break On New Connection
Use Software Break ("===") With Radio Modems
Connect To Last Open Port On Startup
Overwrite Log Files When Opening
Error Checking For Script Files
Send CK On Baud Rate Change (CB Command)
Echo Characters
Wait for Prompt in Script File
Finish
Abbrechen

Figure 4: Program settings in BBTalk

4. To run the tests several commands need to be sent to the ADCP.
Select the menu ***File → Send script file*** or press ***<F2>***.
Select the file ***C:\Program Files (x86)\RD Instruments\RDI Tools\TestWH.rds.***
This file contains a set of commands for the ADCP which is now executed one after another:
CR1, TS?, PS0, PT8, PT9, PT3, PT6.
The results are saved to a *.txt file in the folder ***C:\ Program Files (x86)\RD Instruments\RDI Tools***.

3 VmDas Acquisition Software

The software VmDas is used for data acquisition and playback.

1. Start the VmDas program from the desktop of the operator PC
2. Select ***File*** → ***Collect Data*** and then import the default configuration settings using ***Options*** → ***Load***. The default configurations are ***C:\ADCP\600kHz_WorkhorseMariner\config\600kHz_WorkhorseMariner.ini*** and ***C:\ADCP\150kHz_OceanSurveyor\config\150kHz_OceanSurveyor.ini***
3. The configuration settings should be checked before data acquisition. Enter the menu ***Options*** → ***Edit Data Options*** for editing the settings described in the following chapters.
4. After checking the settings carefully **start the data acquisition**. Select the menu ***File*** → ***Collect Data*** or press the button at the upper left of the main window. The data recording starts immediately and the screen looks about the same as the screenshot in Figure 5.

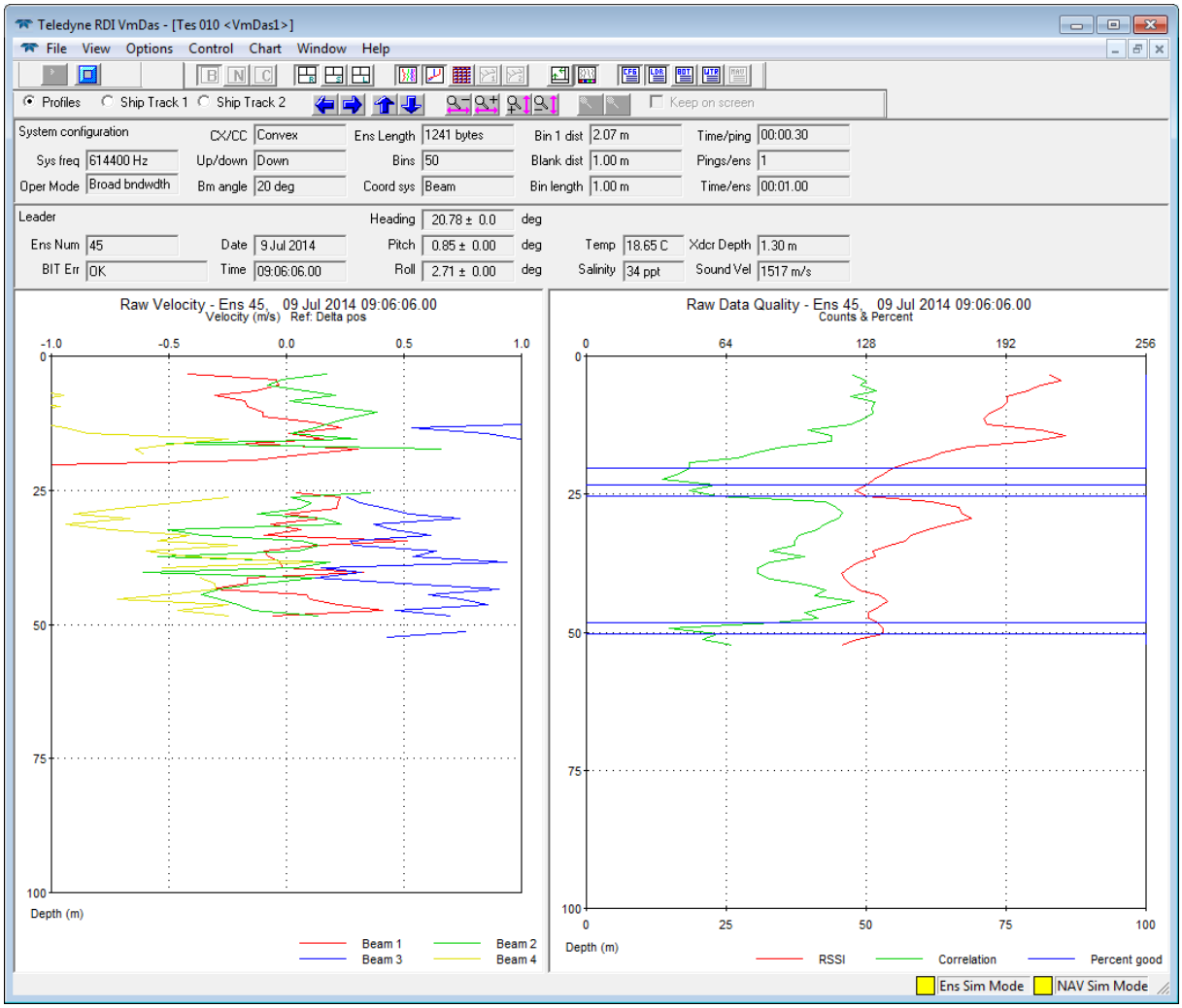

Figure 5: VmDas screen layout during data collection (raw display mode)

3.1 Communications Settings

Here, only the settings for the 600kHz ADCP are shown, screenshots of the correct settings for the 150kHz ADCP can be found in "C:\ADCP\150kHz_OceanSurveyor\documentation\screenshots_settings\".

The Communications tab (in menu ***Options → Edit Data Options***) configures the serial or network connections to the ADCP, the GPS and the motion sensor. Ensure that the settings for the three COM ports are as shown in Figure 6 (red circle). If not, select the ADCP and NMEA inputs on the left and apply the correct settings in the bottom part.

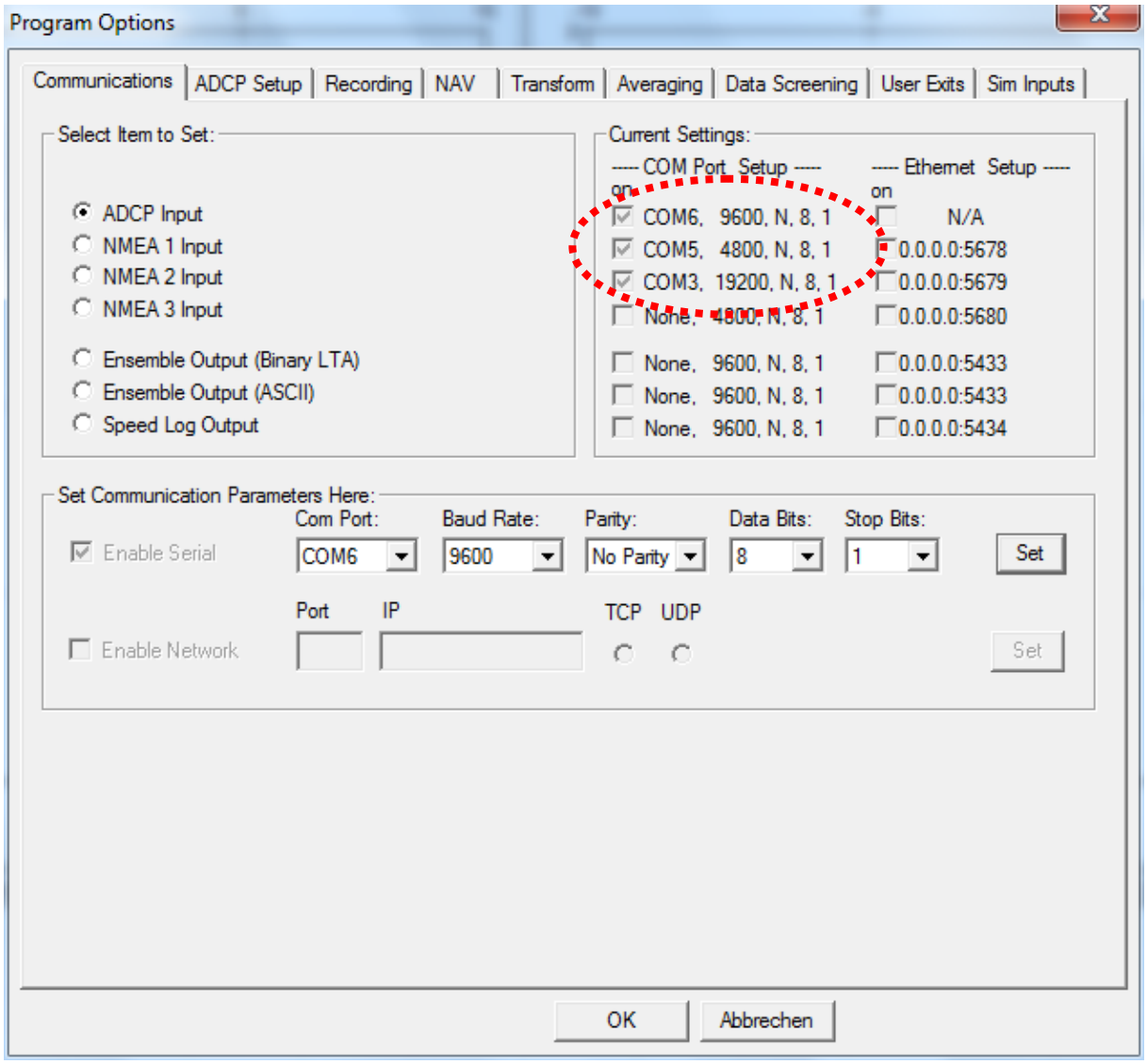

Figure 6: Required communication settings for 600kHz ADCP (red circle)

3.2 ADCP Settings

For the 600kHz ADCP, only the option ***ADCP Setup from File*** is supported by VmDas. That means, changes to the desired resolution must be made in a textfile (please do not overwrite the default file ***WH600_default_settings.txt***). If bottom tracking is activated (default setting and recommended), the ***Ensemble Time*** should be set to "***Ping as fast as possible***".

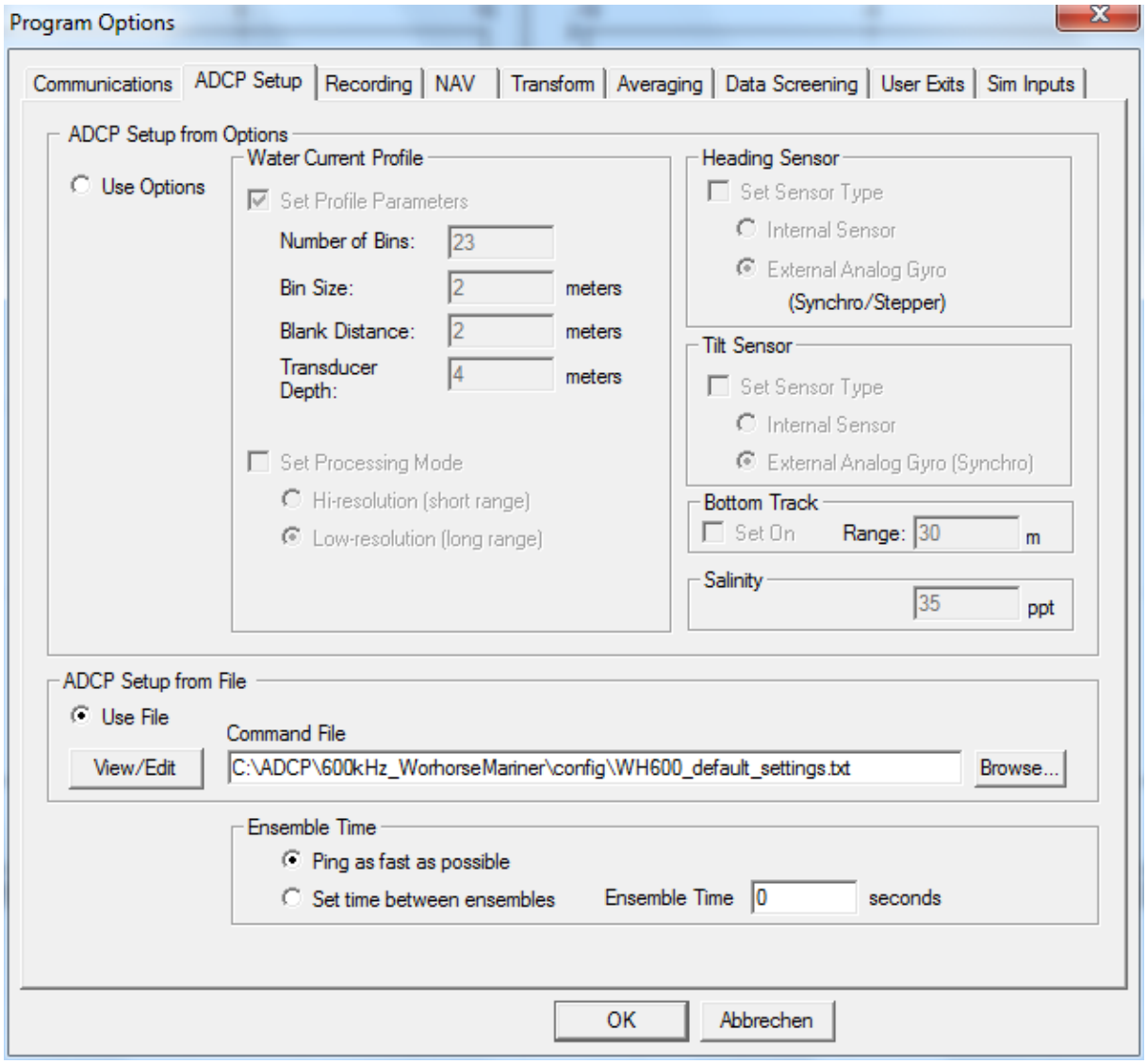

Figure 7: ADCP and auxiliary sensor setup

3.3 Changes in the ADCP Setup File

The setup file contains the following commands (Table 2), that can be modified by the user:

Table 2: command description

Command	Description	Default
CR	Retrieve Parameters	CR1
CF	Flow Control	CF11110
BM	Bottom Track Mode	BM5
BP	Bottom-Track Pings Per Ensemble	BP1
BX	Maximum Tracking Depth	BX1500
EA	Heading Alignment	EA03400
EB	Heading Bias	EB0
ED	Depth of Transducer [decimeter]	ED40
ES	Salinity [PSU]	ES35
EX	Coordinate Transformation	EX11111
EZ	Sensor Source	EZ1111101
WA	False Target Threshold Maximum	WA50
WB	Mode 1 Bandwidth Control	WB0
WD	Data Out	WD111100000
WF	Blank after Transmit [centimeter]	WF200
WN	Number of Depth Cells	WN23
WP	Pings Per Ensemble	WP1
WS	Depth Cell Size [centimeter]	WS200
WV	Ambiguity Velocity	WV175
TE	Time Per Ensemble	TE00:00:01.46
TP	Time Between Pings	TP00:00.73
CK	Keep Parameters	CK
CS	Start Pinging (Go)	CS

Only the settings marked red should be modified according to the desired range and resolution. WB0 stands for wide bandwidth with a high sample rate and a low profiling range, WB1 should be chosen for narrow bandwidth with a low sample rate and a high profiling range.

3.4 Recording Settings

The Recording tab (in menu ***Options → Edit Data Options***) configures the recording options for your survey/expedition. Choose an adequate name for your survey/expedition. Set the primary path for recorded files to ***C:\ADCP\600kHz_WorkhorseMariner\data*** as shown in Figure 8. If a backup is desired, check ***Dual Output Directories*** and provide a path (***H:\Scientist\data\ADCP***).

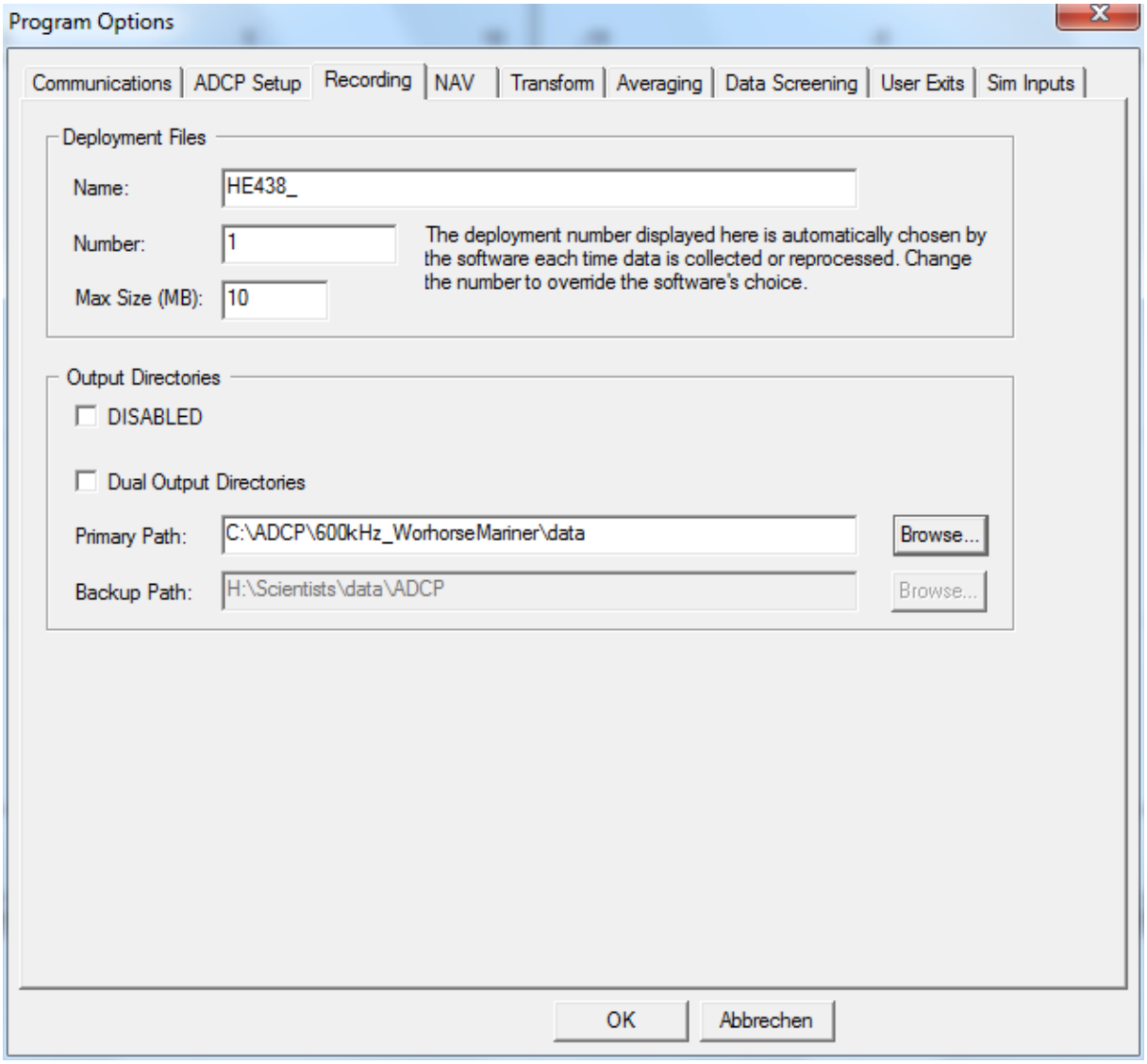

Figure 8: Recording settings; make sure to set correct output and backup directories.

3.5 Navigation Settings

This tab configures the navigation input sources for the ship's position and the ship's speed over ground. Ensure the settings are as shown in Figure 9.

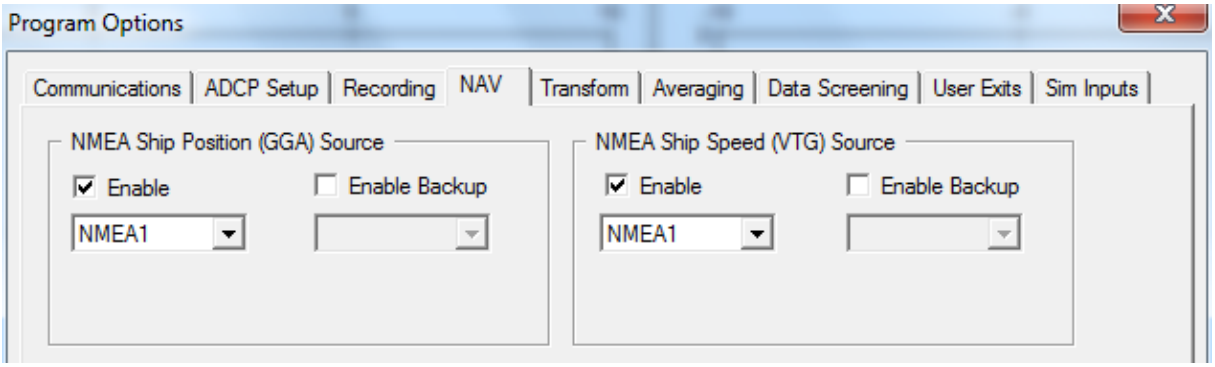

Figure 9: Required navigation input settings

3.6 Transformation Settings

The reference beam 3 of the ADCP is mounted 34° relative to the ship's longitudinal axis (Figure 10) which has been detected by a bottom and water track measurement. Ensure this offset is given as the EA Heading Alignment Error in the configuration!

The Transform tab configures heading and roll/pitch input sources as well as angular offsets for each parameter. Please ensure all settings are as shown in Figure 11.

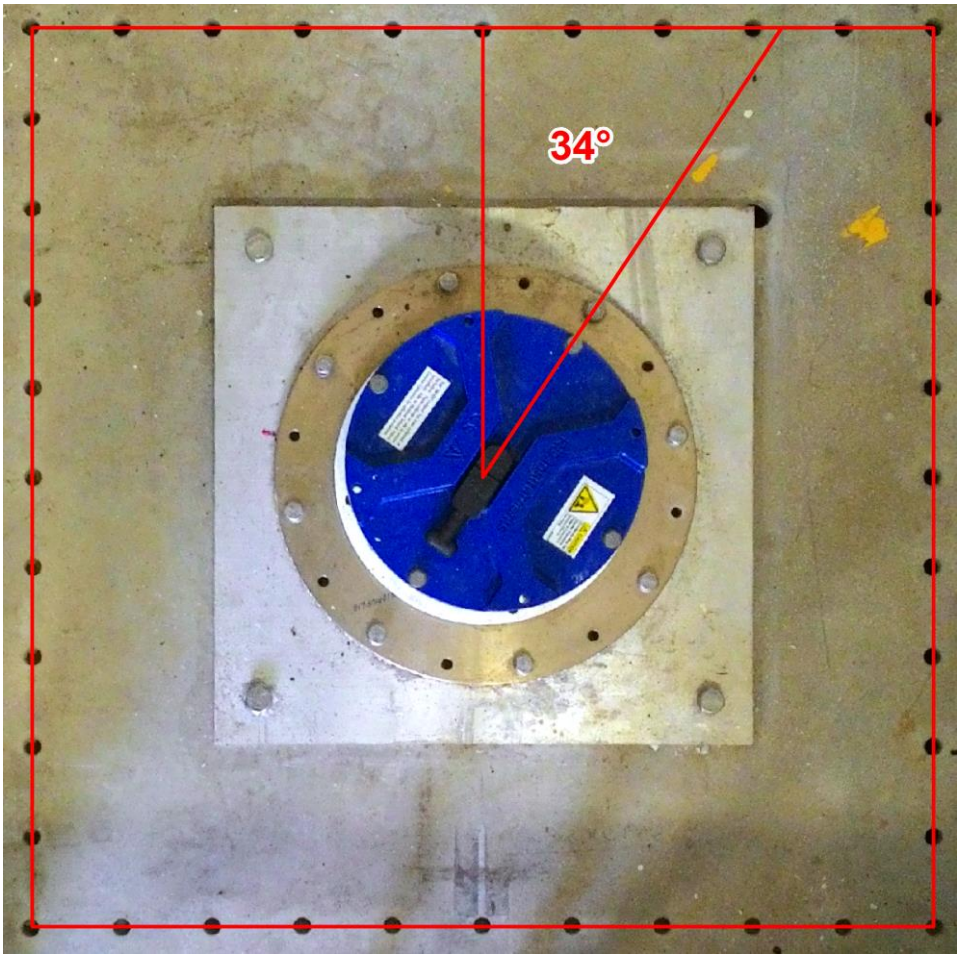

Figure 10: mounting and orientation of the 600kHz ADCP in the moon pool

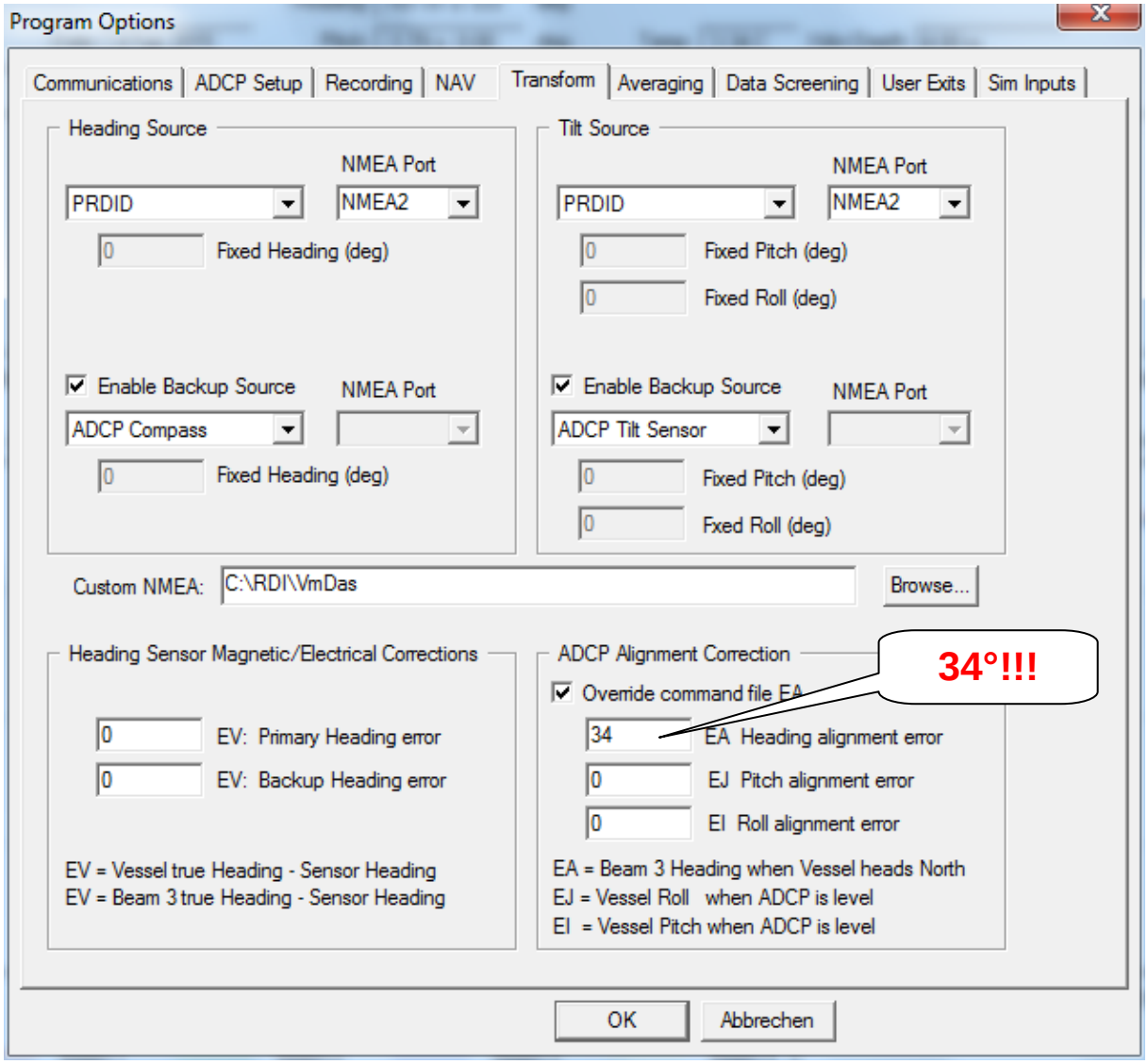

Figure 11: Required transformation settings

3.7 Averaging Settings

This tab (in menu ***Options*** → ***Edit Data Options***) configures the averaging of the ADCP raw data. Configure as shown in Figure 12 or adjust the settings according to your requirements. The settings will not affect the raw data.

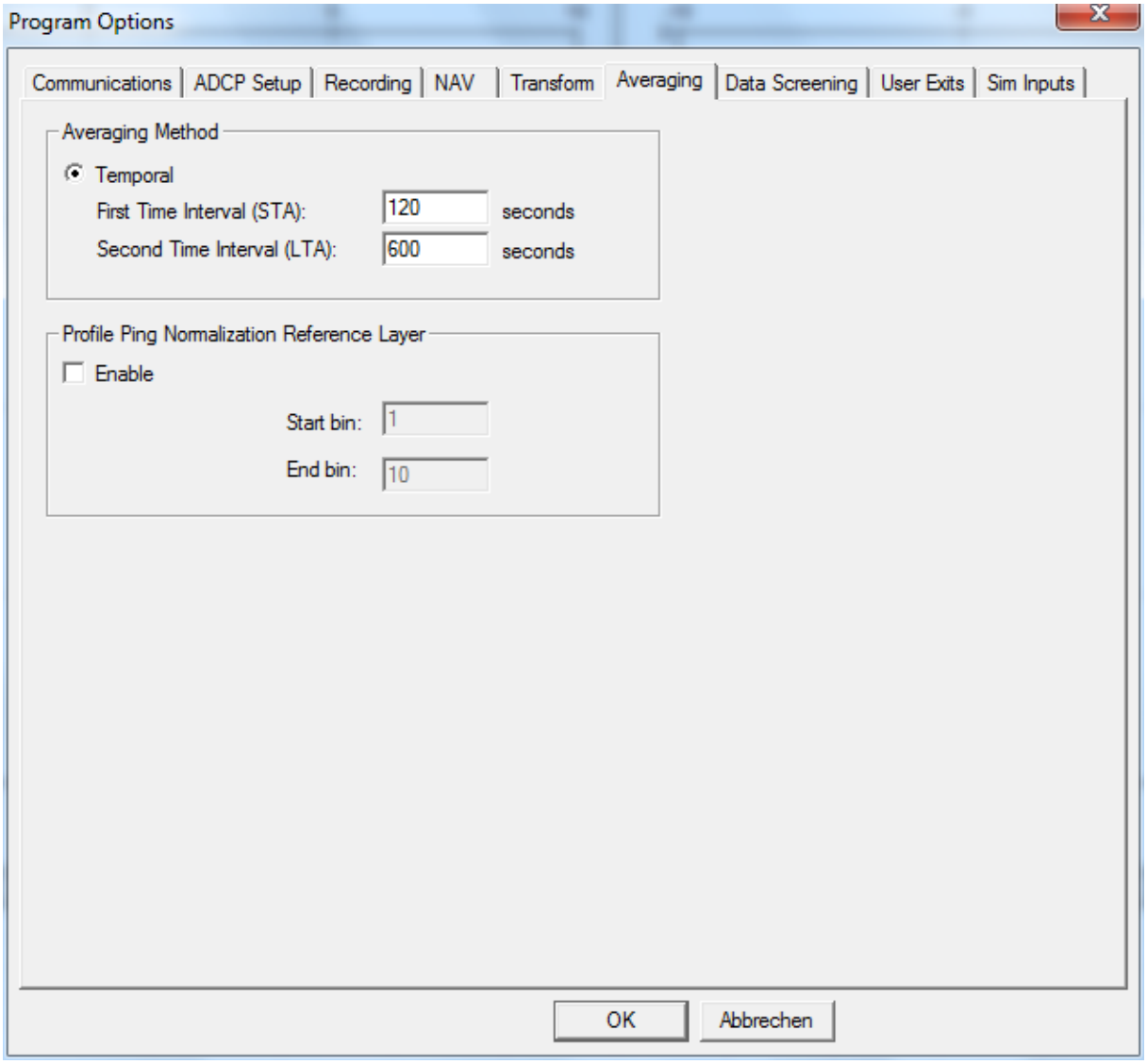

Figure 12: Averaging settings, adjustable to your requirements

3.8 Data Screening Settings

The Data Screening tab (in menu ***Options*** → ***Edit Data Options***) configures the screening settings for the visualization of the ADCP raw data. Adjust these settings according to your requirements.

You can set limits for RSSI (amplitude), correlation, percent good, error velocity, vertical velocity and fish screening. If the raw values are below the selected minimum limits the values will not be displayed nor included in the short time and long time averages. The raw data is of course not affected by these settings.

3.9 Short Term Averages (STA) in VmDas

VmDas offers the possibility to display already averaged velocities (according to the averaging settings, Figure 12) on a map including the ship movement on a map (screenshot

in Figure 13). Therefore, press the tab in the toolbar. You can change the references / displayed velocities under ***Options → Edit Display Option*** (this will not affect the raw data collection).

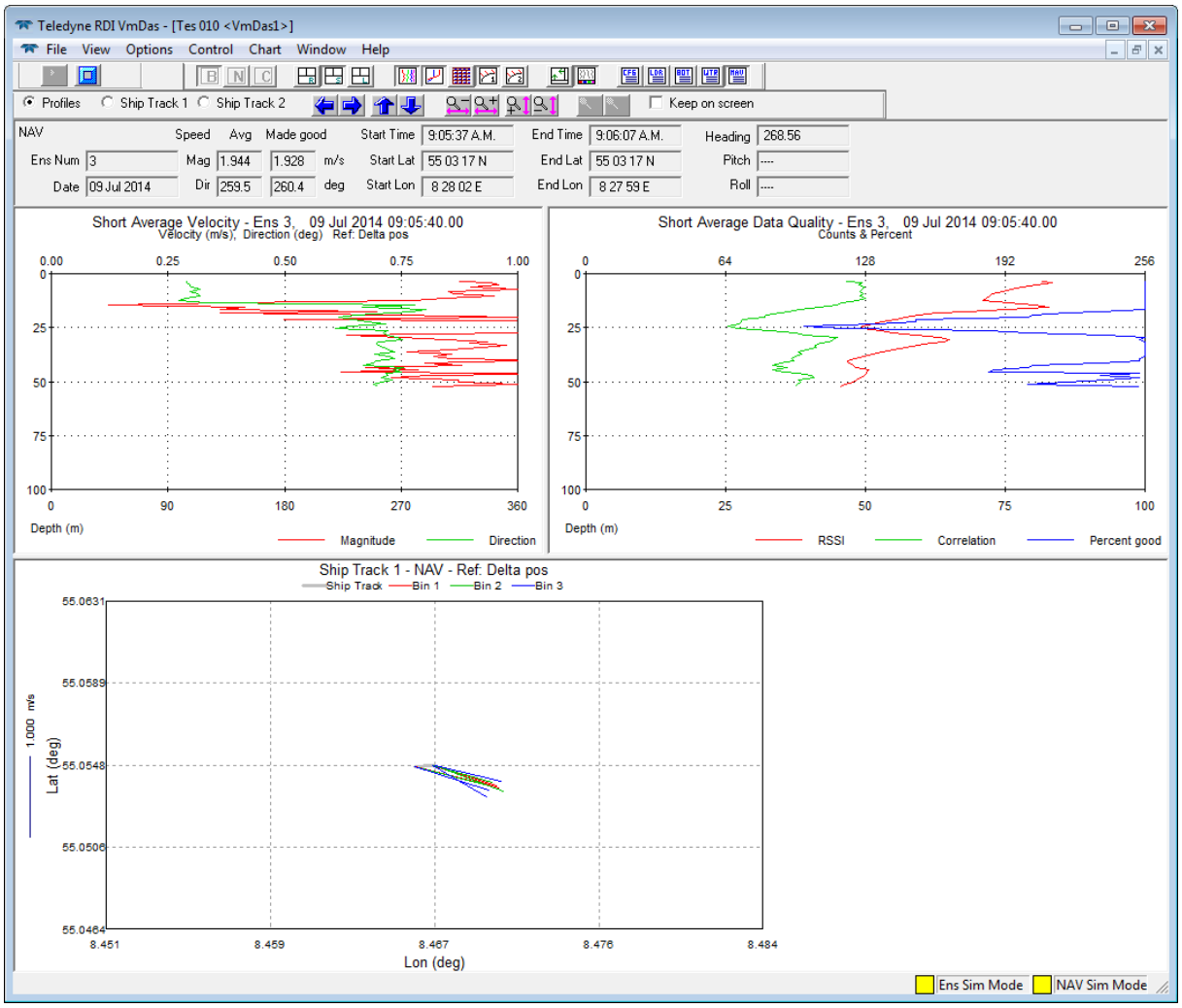
Teledyne RDI VmDas - [Tes 010 <VmDas1>]
File View Options Control Chart Window Help
Profiles Ship Track 1 Ship Track 2 Keep on screen
NAV Speed Avg Made good Start Time 9:05:37 A.M. End Time 9:06:07 A.M. Heading 268.56
Ens Num 3 Mag 1.944 1.928 m/s Start Lat 55 03 17 N End Lat 55 03 17 N Pitch ----
Date 09 Jul 2014 Dir 259.5 260.4 deg Start Lon 8 28 02 E End Lon 8 27 59 E Roll ----
Short Average Velocity - Ens 3, 09 Jul 2014 09:05:40.00
Velocity (m/s), Direction (deg) Ref: Delta pos
Depth (m)
Magnitude
Direction
Short Average Data Quality - Ens 3, 09 Jul 2014 09:05:40.00
Counts & Percent
Depth (m)
RSSI
Correlation
Percent good
Ship Track 1 - NAV - Ref: Delta pos
Ship Track Bin 1 Bin 2 Bin 3
1.000 m/s
Lat (deg)
Lon (deg)
Ens Sim Mode
NAV Sim Mode

Figure 13: Screenshot of WinADCP during data replay

4 WinADCP

The WinADCP software can be used for visualization and export of the recorded ADCP data (screenshot in Figure 14). For a detailed description, please read the ***WinADCP User Manual*** for help on how to use the software.

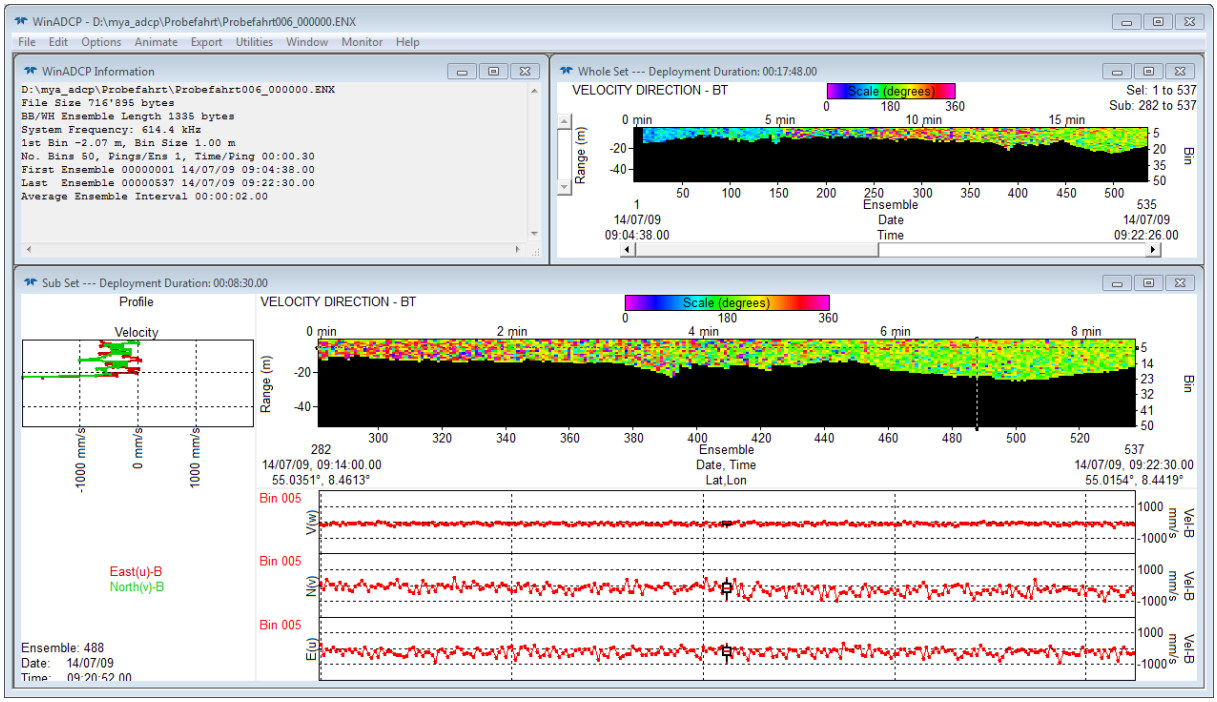

Figure 14: Screenshot of WinADCP during data replay

4.1 Exporting Data

Besides several displaying and replay features of the collected data, WinADCP is used to Export the data to ASCII-format. This is done using ***Export*** and then choosing ***Series/Ancillary***. Here, a selection can be made which bins should be exported and which primary data types (typically the zonal, meridional and vertical velocities) and which ancillary data types should be exported (typically Lat/Lon). If bottom track is chosen as velocity reference, the exported velocities are already representing the true water velocities (i.e. ship movement corrected).

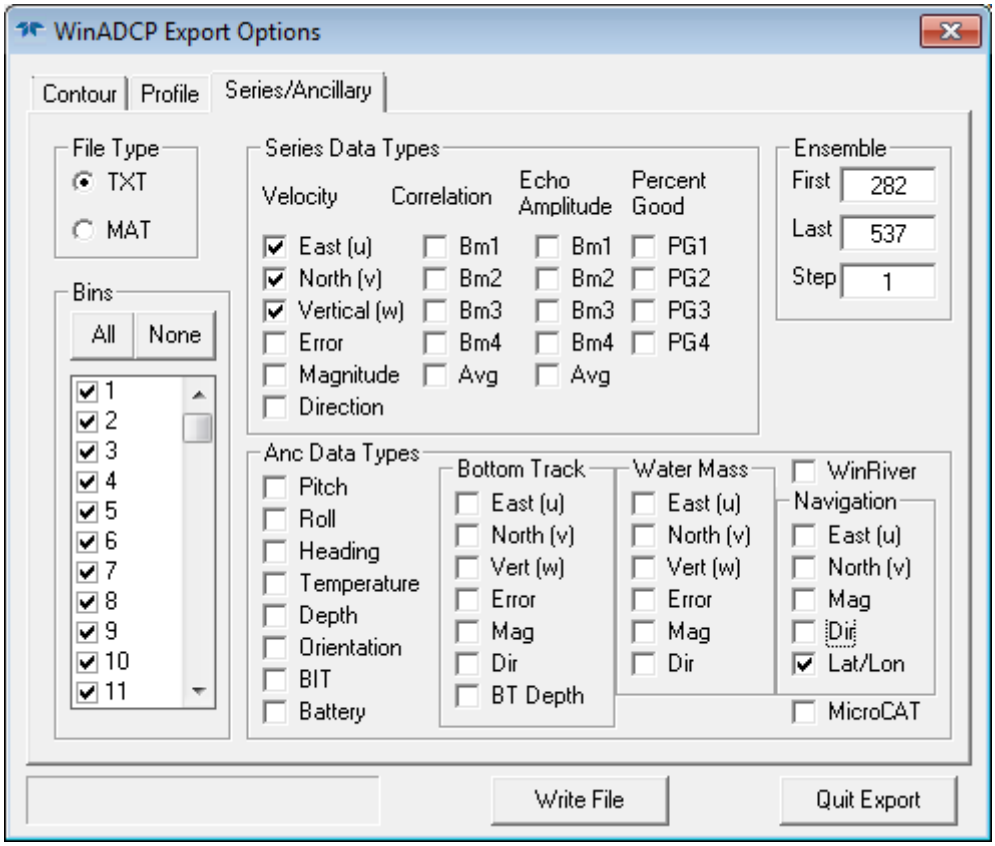

Figure 15: Data export in WinADCP